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Original Article

EVALUATION OF EFFICACY OF FUNGICIDES AGAINST PHOMOPSIS LEAF BLIGHT OF BRINJAL (*SOLANUM MELONGENA* L.)

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ABSTRACT

In the present study, we evaluated the efficacy of commercially available four fungicides such as Captan 50% WP, Carbendazim 50% WP (Bavistin), Dithane M-45 (Mancozeb) and Antracol 70% WP (Propineb) against Phomopsis vexans causing Phomopsis leaf blight of brinjal in laboratory and greenhouse. Among the fungicides, Carbendazim 50% WP proved to be effective by inhibiting the mycelial growth of P. vexans assayed at all the concentrations in in vitro test. The greenhouse experiments revealed that all the four fungicides applied as a combination of seed and foliar treatments were significantly ($p \leq 0.05$) showed the Phomopsis leaf blight disease protection over control. Among the four fungicides, Carbendazim 50% WP significantly ($p \leq 0.05$) showed the highest percentage of disease protection over control (87.9) than other three fungicides. Hence, the present study suggested that the fungicide, Carbendazim 50% WP may be used to control the Phomopsis leaf blight disease of Brinjal in the field conditions.

KEYWORDS: Fungicide, Phomopsis Leaf Blight, Phomopsis Vexans, Solanum Melongena L

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INTRODUCTION

Brinjal (*Solanum melongena* L.) is the second most important vegetable crop in respect to area (680 thousand ha) and production (27.6%) of world production in India (National Horticulture Database, 2011; Vanitha *et al*., 2013). It grows as an annual crop throughout the year in tropics and sub-tropics (Chaudhury and Kalda, 1968). However, it is known to suffer by many diseases. Among them, the Phomopsis leaf blight and fruit rot disease caused by *Phomopsis vexans* (Sacc. Syd.) 'Harter' has been considered as one of the major constraints in the brinjal cultivation (Das, 1998). The disease was first reported from the Gujarat state in 1914 and since then from many parts of India. In general, the crop loss due to this disease ranges from 15-20% (Hossain *et al*., 2013). Many reports are available with the use of plants extracts, bioagents and hot water to control the disease (Srinivas *et al*., 2005; Islam and Meah, 2011, Das *et al*., 2014). Besides, the seed treating fungicides has been assayed against *P. vexans* (Srinivas *et al*., 2005, Das *et al*., 2014). In the present study, the experiments were conducted to evaluate the efficacy of fungicides against Phomopsis leaf blight disease of brinjal under laboratory and greenhouse conditions.

MATERIALS AND METHODS

Seed Samples

The seeds of brinjal (*Solanum melongena* L.) cultivar 'MEBH–9' were purchased from the local seed agencies of Mysore (India). Seeds were thoroughly washed with distilled water to remove surface treated chemicals, blot dried and used for the experiment.

Phomopsis Vexans

The strain *Phomopsis vexans* Pv1 (Accession No KF994965) which is highly virulent and pathogenic to brinjal plants was collected from the culture collection of the Department of Studies in Biotechnology, University of Mysore, Mysore, Karnataka, India. The strain was grown on Potato dextrose agar (PDA) and used for the experiment.

Fungicides

The commercially available four fungicides such as Captan 50% WP, Carbendazim 50% WP (Bavistin), Dithane M-45 (Mancozeb) and Antracol 70% WP (PROPINEB) were purchased from the local market in Mysore, India and used for the experiment.

Efficacy of Fungicides against Mycelial Growth of *P. vexans*

The efficacy of the fungicides against *P. vexans* was studied using poisoned food technique (Nene and Thaplyal, 1979) at different concentrations (100, 200, 250, 500 and 1000 ppm). The mycelial growth of *P. vexans* was measured and the percent growth inhibition (PGI) was calculated using the following formula:

$$I = [(C – T)/ C] \times 100$$

Where, I = percent inhibition, C and T = growth of *P. vexans* in control and treatment respectively.

Efficacy of Fungicides against Phomopsis Leaf Blight Disease of Brinjal under Greenhouse Conditions

The greenhouse experiments were conducted at the Department of Studies in Biotechnology, University of Mysore, and Mysore. The experiments consisted the following chemical fungicide treatments: T_1 – Captan 50% WP; T_2 – Carbendazim 50% WP; T_3 – Dithane M-45; T_4 – Antracol 70% WP and T_5 – Untreated control. They were laid out in a randomized complete block design (RCBD) manner with three replications. The experiment was repeated three times. The seeds of brinjal were separately treated with each fungicide as per the instruction of manufacturer. The seeds soaked in distilled water served as control. They were sown in the planting trays filled with sterilized potting medium (soil: sand: farm yard manure @ 2:1:1 v/v/v) and grown under greenhouse conditions (day/night light cycle of 16/8 h and temperature of 28/20°C at 65% relative humidity). Twenty-day-old seedlings were spray-inoculated with the conidial suspension of *P. vexans* strain Pv1 (1×10^8 conidia ml^{-1}) using a sprayer preferably during humid conditions at 5 days intervals. The fungicide spraying was also given separately for each treatment at 30, 40 and 50 days after sowing (DAS) according to the concentration suggested by the respective company. Control seedlings were sprayed with distilled water. The inoculated plants were covered with moistened polythene cover to maintain the relative humidity and incubated under greenhouse conditions up to 60 days. The development of Phomopsis leaf blight disease was recorded after 7 days of last sprayings and the per

$$\text{Disease protection over control (\%)} = \frac{\text{Control} - \text{Treated}}{\text{Control}} \times 100$$

Statistical Analysis

All data were subjected to arcsine transformation and analysis of variance (ANOVA) using SPSS, version 17 (SPSS Inc., Chicago, IL). The significant differences between the treatment means were compared using Highest Significant Difference (HSD) as obtained by Tukey's test at $p \leq 0.05$ level.

RESULTS

Efficacy of Fungicides against Mycelial Growth of *P. vexans*

Among the four fungicides, Carbendazim 50% WP proved to be effective by inhibiting the mycelial growth of *P. vexans* tested in *in vitro*. It showed 100% inhibition of mycelial growth of *P. vexans* at all the concentrations tested. The strain *P. vexans* Pv1 has the ability to grow in other three fungicides used at all the concentrations. These three fungicides also showed maximum percentage of inhibition of mycelial growth of *P. vexans* at 1000 ppm. The mycelial growth of *P. vexans* and its percentage inhibition against all the four fungicides tested were shown in the Table – 1.

Efficacy of Fungicides against Phomopsis Leaf Blight Disease of Brinjal under Greenhouse Conditions

The greenhouse experiments revealed that all the four fungicides applied as a combination of seed and foliar treatments significantly ($p \leq 0.05$) showed the Phomopsis leaf blight disease protection over control. Among the four fungicides, Carbendazim 50% WP significantly ($p \leq 0.05$) showed the highest percentage of disease protection over control (87.9) than other three fungicides evaluated. This was followed by Dithane M-45 with 83.0% of disease protection over control. The fungicides, Captan 50% WP and Antracol 70% WP also showed 81.6 and 78.2% of disease protection over control respectively (Figure 1).

DISCUSSIONS

In the present study, we evaluated the efficacy of four fungicides such as Captan 50% WP, Carbendazim 50% WP, Dithane M-45 and Antracol 70% WP against Phomopsis leaf blight disease caused by *P. vexans* in brinjal under laboratory and greenhouse. Among the fungicides, Carbendazim 50% WP completely inhibited of mycelial growth of *P. vexans* at all the concentrations in *in vitro*. Hossain *et al*. (2013) reported that Bavistin 50 WP (0.1%) proved to be effective arresting the spore germination and mycelia growth of *P. vexans* assayed in *in vitro* test. Recently, Das *et al*. (2014) also reported Carbendazim at 0.1% showed complete inhibition of the mycelial growth of *P. vexans*. Our studies also revealed from the greenhouse evaluation that all the four fungicides used significantly ($p \leq 0.05$) showed the Phomopsis leaf blight disease protection over control. Among them, Carbendazim 50% WP significantly ($p \leq 0.05$) showed the highest percentage (87.9) of disease protection over control. Hossain *et al*. (2013) reported Bavistin 50 WP (0.1%) reduced by 52.22, 58.67, 74.19 and 83.09% leaf area diseased caused by *P. vexans* in eggplant, respectively at pre-flowering, post-flowering, fruiting and fruit ripening stages.

CONCLUSIONS

In conclusion, Carbendazim 50% WP used in the present study were considered as the most effective fungicide used to control the Phomopsis leaf blight disease in Brinjal. Hossain *et al*. (2013) suggested that Bavistin 50 WP (0.1%) alone or in combination with micronutrients (Gypsum, ZnO and Boric acid) could be used for management of Phomopsis blight and fruit rot of eggplant in the field. Further, field trail has to be conducted to evaluate the application of Carbendazim 50% WP as seed and foliar treatment to control Phomopsis leaf blight disease in Brinjal.

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APPENDICES

Table 1: Efficacy of Fungicides against Mycelial Growth of *P. vexans*

Fungicides	Concentration (Ppm)									
	100		200		250		500		1000	
	MG	I	MG	I	MG	I	MG	I	MG	I
Captan 50% WP	8.0	11.1	6.5	27.7	5.9	34.4	2.3	74.4	1.9	78.9
Carbendazim 50% WP	0	100	0	100	0	100	0	100	0	100
Dithane M-45	7.6	15.5	6.0	33.3	5.3	41.1	2.0	77.8	0.9	90.0
Antracol 70% WP	8.8	2.2	8.1	10.0	6.5	27.8	4.8	46.7	2.9	67.8

MG = Mycelial growth (cm); I = Inhibition (%)

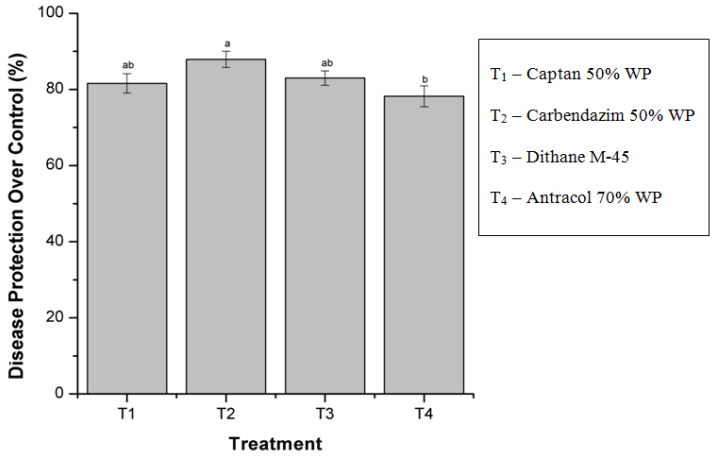

Figure 1: Efficacy of Fungicides against Phomopsis Leaf Blight Disease of Brinjal under Greenhouse Conditions